

long-distance companies is the purchase of carrier access services, which are obtained on a per-minute-of-use basis from local exchange companies. Thus, in contrast to a typical public utility that is very capital intense, the provision of long-distance services is now characterized by relatively high variable costs.

Finally, it is important to note that while the capital intensity of the long-distance industry has fallen, it is still very expensive to construct a nationwide long-distance transmission network. Moreover, in the case of the construction of a fiber optic network, the assets deployed involve considerable sunk costs. Accordingly, it is tempting to conclude that such costs continue to constitute significant barriers to entry into the long-distance marketplace.

Such a conclusion is erroneous, however, for two fundamental reasons. First, the argument establishes the wrong standard by which to judge the height of barriers to entry. That is, entry barriers should be measured by examining the economic characteristics of costs for the *most likely mode of entry*. Thus, the fact that the construction and deployment of a nationwide fiber-optic long-distance network is costly and involves considerable sunk costs is irrelevant, because that is not the least-cost (preferred) mode of entry. That is, profit-maximizing firms will typically seek to enter markets via a least-cost strategy that minimizes their exposure to losses if the new venture fails. In the case of the long-distance industry, this least cost path of entry does not involve de novo construction of a nationwide fiber optic transmission network but, rather, entry as a reseller. Specifically, a new entrant will typically purchase or lease transmission capacity on an existing network rather than construct its own facilities. The firm can then combine that transmission capacity with its own marketing, functions, and features, to capture long-distance customers. At some point, as the customer base expands, it may (or may not) become economical for these new entrants to begin to construct their own transmission networks, depending upon the price and availability of leased facilities. By waiting to construct their own networks these new entrants are able to (1) delay the expenditure on assets that involve considerable sunk costs while still competing for customers, and (2) minimize the risk that those sunk costs will not be recouped by the ex ante development of a base of customers.

The second error contained in arguments involving network costs as a barrier to entry (and virtually all other arguments that continue to claim the existence of high entry barriers into the long-distance market on the basis of a theoretical examination of industry cost conditions) is that they ignore actual marketplace evidence on entry in the post-divestiture period. An examination of the actual patterns of observed entry and expansion provides overwhelming evidence that both regulatory and economic barriers to entry and expansion are low. For example, in figure 1 we see the time path of the number of interexchange competitors. By 1994, we see that roughly 420 long-distance competitors were vying for the patronage of consumers in the United States. Obviously, not all competitors compete in every geographic location. Nevertheless, it is important to note that, once a long-distance carriers has established a point-of-presence (or POP) in a LATA, it can very quickly begin to provide interexchange service to any specific area within that LATA simply by

purchasing carrier access from the local exchange carrier to its POP. As a result, even those areas without a significant number of competitors are assured the protection of competitive pricing by virtue of the ease of entry. Beyond the flood of entrants into the interexchange industry, new carriers have demonstrated that they are quite capable of successfully competing for interexchange customers. In figure 2, we see that the growth rates of presubscribed customers for MCI, Sprint, and "Other Carriers" have been very robust. Given the numerous regulatory and economic developments of the past decade and the magnitude of observed entry, one can only conclude that barriers to entry into the long-distance industry are extremely low.⁹

A second feature of industry structure that is often thought to influence conduct and performance is market concentration, which is driven by the number of industry participants and their market shares. As seen above in figure 1, there are a large

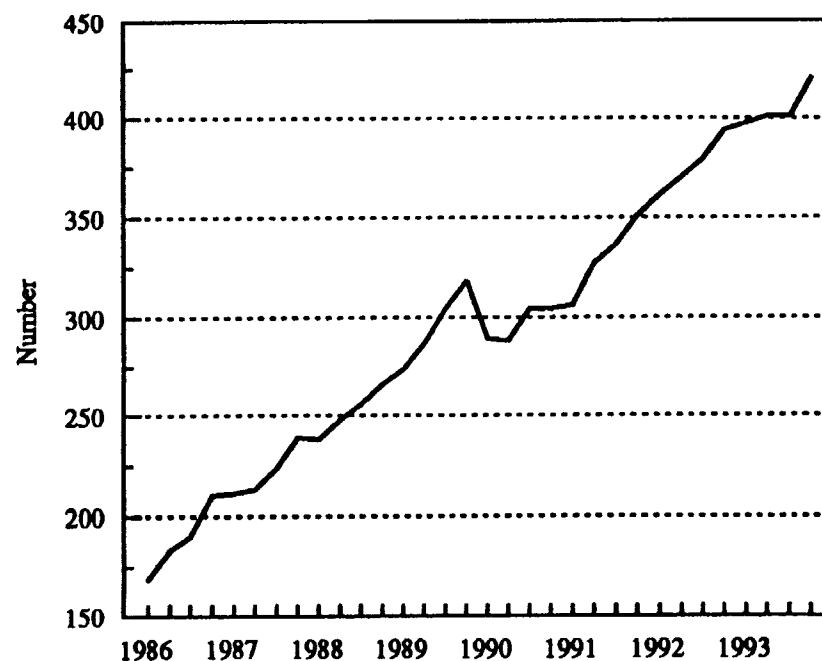


Figure 1. Long-Distance Firms Purchasing Equal Access

Source: *Trends in Telephone Service*, Industry Analysis Division, Federal Communications Commission, May 1994.

9 Observed entry and expansion not only demonstrate an absence of significant barriers to entry but also provide prima facie evidence of an absence of predatory pricing.

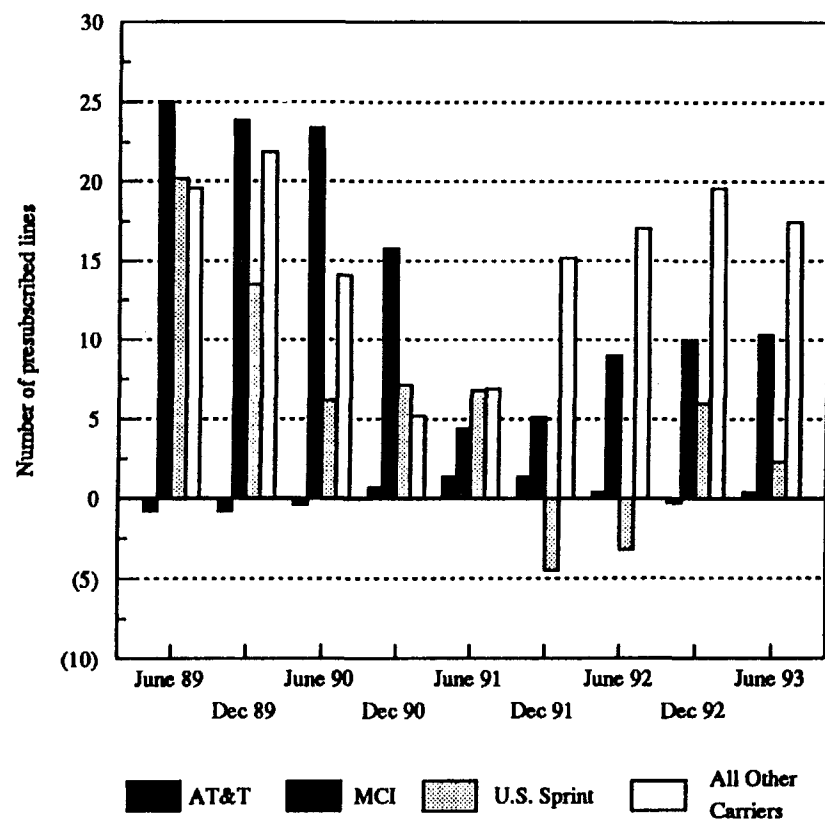


Figure 2. Growth Rate of Presubscribed Customers

Source: Trends in Telephone Service, Industry Analysis Division, Federal Communications Commission, May 1994.

number of competitors in the interexchange marketplace today. Many of these firms, however, do not provide ubiquitous originating service throughout the United States. A survey of the number of long-distance competitors in specific cities, however, is revealing. Table 1 shows the results of a survey of long-distance carriers that were available to residential customers on a 1+ (equal access) basis in September 1993. There, we see that major metropolitan areas typically have between 20 and 30 long-distance firms from which customers may choose. Moreover, table 1 also reveals that even in smaller communities and rural areas, there are typically a number of long-distance competitors from which to select.

Another key characteristic of industry structure is the distribution of market shares—particularly the market share of the largest firm, in this case AT&T. The measurement of market share for the interexchange industry, however, must be

Table 1. Number of Long Distance Carriers in Various Cities and Towns		
Major Metropolitan Areas	Population ^{1,2}	Long Distance Firms ³
Baltimore	2,382,000	30
Denver	1,623,000	23
New York City	8,547,000	32
San Francisco	1,604,000	25
Milwaukee	1,432,000	22 ⁴
Salt Lake City	1,072,000	26
Smaller Communities		
Helena, Montana	24,569	14
Moose, Wyoming	100	18
Carthage, Tennessee	2,386	37
Hope, Arkansas	9,643	11

¹U.S. Bureau of the Census. *Statistical Abstract of the United States: 1991* (111th edition), Washington, D.C., 1991.

²U.S. Bureau of the Census. *1990 Census of the Population: General Population Characteristics*, Washington D.C., May 1992.

³These are the firms given by the local exchange company business office as offering long distance telephone service on a "1+" basis.

⁴The local exchange company representative indicated that there were 11 "primary" long distance companies chosen by residential subscribers, but that all 22 carriers were available for subscription on a "1+" basis for Milwaukee customers.

approached with caution for at least two reasons. First, the level and time path of market share movements for AT&T reflect not only the normal marketplace rivalries but also the fact that AT&T has been and continues to be highly regulated at both the federal and state levels. Such regulation is likely to distort observed market shares, potentially generating an inference of market power where none exists.¹⁰ Second, while minutes-of-use and revenue-based market share data are more readily available, a more meaningful market share measure is given by the transmission capacities of interexchange firms. Such capacities determine the ability of these firms to discipline any potential attempts by the largest firm to raise prices above competitive levels. Data compiled by the FCC indicate that AT&T's competitors' fiber optic capacity-based market share is in excess of 50 percent.

Equally revealing is the rate of decline in AT&T's market share over time. Regardless of the unit of measurement used, this share has fallen markedly since the divestiture. Figure 3 shows the time path of AT&T's minutes-of-use based market share. This share has fallen from roughly 85 percent in the third quarter of 1984 to approximately 60 percent. This significant decline in the incumbent firm's market share suggests an absence of significant expansion barriers in this industry.

Not only have numerous new firms entered the market, but these firms have succeeded in capturing a substantial amount of business away from the incumbent supplier. This evidence, in turn, demonstrates a willingness of consumers to switch suppliers in response to what have, in fact, been relatively small price differentials. Therefore, brand loyalty also does not appear to present a significant hinderance to competition in this industry.

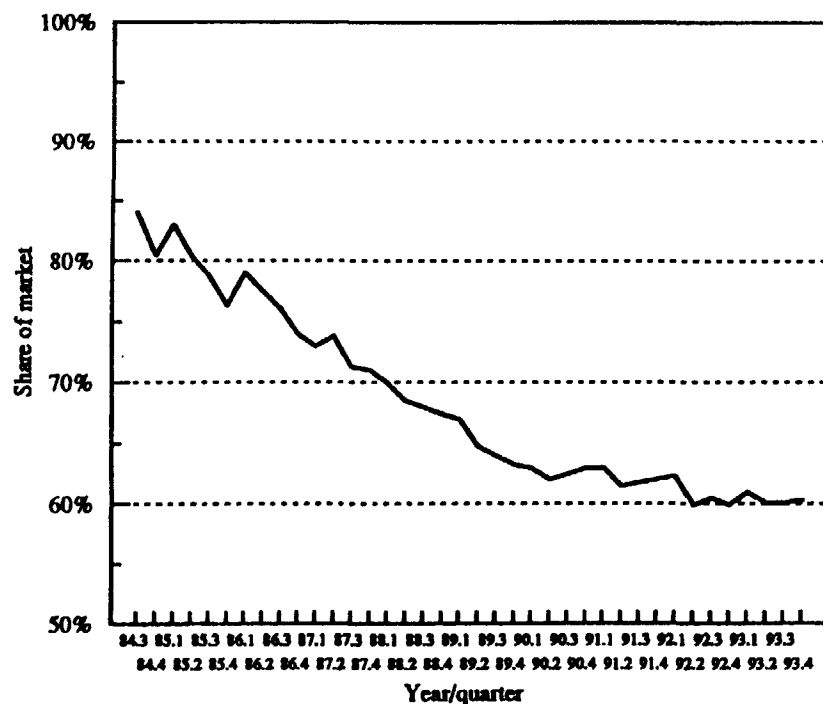


Figure 3. AT&T's Minutes-of-Use-Based Market Share

Source: Trends in Telephone Service, Industry Analysis Division, Federal Communications Commission, May 1994.

Thus, a traditional look at the evolution of market structure in the post-divestiture period reveals an industry with low barriers to entry and expansion and many firms. While the largest firm continues to hold a fairly substantial market share (varying somewhat by which unit of measurement is employed), the ease with which new firms have entered and the success they have had in capturing market share from the incumbent producer strongly suggests that effective competition is both viable and present in this industry.

3.2. Conduct

As we saw in Section 2, industry observers expressed markedly different expectations about how industry conduct would evolve in the post-divestiture period. In light of these divergent expectations, four dimensions of conduct provide noteworthy insights into the evolution of the industry over the past decade: (1) investment; (2) advertising; (3) pricing; and (4) new service offerings. We consider each of these aspects of conduct in turn.

Recall that some observers argued that, despite the divestiture, AT&T's inherent position of strength would result in a dearth of challengers in the long-distance market. That is, given the considerable size advantage of AT&T over its rivals, it was argued that potential entrants would be unwilling to invest the resources necessary to compete successfully with the incumbent firm. This fear has been completely dispelled on two grounds. First, as we saw in figure 1, a multitude of long-distance competitors have entered this market to compete for the patronage of long-distance consumers. Obviously, potential entrants have not been timid about challenging the position of AT&T. Second, not only have new firms entered, but they have also invested significant amounts of resources to develop interexchange networks that are independent of AT&T.¹¹ Sprint's leadership in developing the nation's first all-fiber transmission network appeared to catalyze the subsequent dissemination of fiber as the standard in the interexchange industry. Together, the deployment of fiber and expansion of electronic switching have vastly expanded the capacity of long-distance firms to carry interexchange traffic. Thus, aggressive investment behavior has emerged as a major source of pro-competitive conduct in the interexchange market.

Prior to the divestiture, many industry analysts anticipated that the long-distance industry would bifurcate, with AT&T providing a high priced, high quality service and its competitors providing lower priced, low quality alternatives. In the wake of the divestiture, however, competitors soon began to utilize equal access connections made available to them by the local exchange companies to provide service that is approximately (if not fully) equal in quality to that provided by AT&T. And, as noted, Sprint led the industry with the deployment of the nation's first all-fiber network. The result was a metamorphosis in the advertising and marketing strategies within the industry that few had anticipated. Specifically, AT&T's competitors soon began to engage in advertising touting the high quality of their services, while AT&T has countered with advertising emphasizing the competitiveness of AT&T's prices. The advertising rivalry of long-distance firms has increased in recent years, as firms scramble to attract consumers to their particular services.¹²

11 Much of the investment in this industry has been in the relatively high sunk-cost technology of fiber optic transmission networks. Such an investment strategy by new entrants suggests that these firms are not leery of predatory tactics on the part of the incumbent producer.

12 Porter (1993) reports that advertising intensity in the long-distance industry, measured by the ratio of advertising expenses to sales, increased from 1.7 percent to 2.7 percent in the

This sort of interfirm rivalry along both the price and quality dimensions is inconsistent with tacit collusive behavior.

Another important dimension of conduct involves the pricing behavior of firms in the marketplace. Given the pre-divestiture concerns, the most prominent fear regarding pricing was that AT&T would be able to utilize large scale economies to price so that no competitors would challenge AT&T or survive if such a challenge was mounted. This concern is (or should be), at this point, completely gone. As noted, a multitude of challengers have, in fact, surfaced. They have demonstrated beyond doubt that the minimum viable scale (the minimal size at which firms achieve costs consistent with the ability to successfully compete in the market) is quite small.

A second generic concern about industry pricing that was voiced at divestiture is the possibility of collusion—either overt or tacit. If interexchange firms were to engage in collusion to restrict output, raise prices, or in any other way refrain from the normal rivalry of the competitive process, then consumer welfare would be damaged. In the decade following the divestiture, however, there have been no known attempts by interexchange companies to collude. This lack of collusion is, indeed, a predictable consequence of the underlying economic structure of the interexchange industry. Specifically, the large number of carriers, the diverse and ample capacity of these carriers, the volatility of demand and cost conditions, the dynamic character of technology, and the ease of entry and expansion all act to deter the likelihood of collusion.

The pattern of firm pricing has evolved considerably over the post-divestiture era. In the early days following divestiture, carriers without equal access were granted a 55 percent discount on their interstate access charges. Moreover, this discount was generally mirrored in intrastate access charges as well. This discount permitted the new entrants to charge considerably lower rates than AT&T for interexchange services. As equal access has expanded, however, these discounts have eroded, costs have converged, and price differences between AT&T and its competitors have narrowed. See figure 4. Two reasons appear to account for this convergence of prices. First, as the percentage of equal access connections has grown, the underlying differences between the services offered by AT&T and its competitors have shrunk. Most importantly, differences in dialing requirements and signal quality have disappeared. The result is that consumers increasingly view the services of all long-distance carriers as roughly comparable if not completely equal. Second, as non-premium access connections came to an end, the discount on access charges levied on AT&T's competitors also came to an end. The result has been a convergence of costs and, predictably, prices. This convergence of prices and the temporal correlation of prices is also consistent with the evolution of competitive pricing in the presence of increasingly similar cost and reduced product

differentiation.

In addition, expectations that anticompetitive price leadership would arise in this industry have also failed to prove accurate. Indeed, an examination of the full array of service offerings by interexchange companies and their corresponding time paths of price levels reveals that, while observed prices of competing firms have tended to move more or less together over time, there does not seem to be a uniform pattern of single-firm leadership. Instead, it has not been uncommon for AT&T to change some rates without evoking an immediate response by rival firms, and these other firms have similarly made price changes independent of any change in AT&T's rates. Moreover, regardless of which firm has led and which firms have followed as seen in figure 4, prices have generally tended to move downward since divestiture. Therefore, whether leadership is present or not, observed pricing does not appear to be consistent with the sort of anticompetitive scenario envisioned by the Natural Monopoly Advocates at divestiture. Also, as we explain below, much of the price changing that has occurred in this industry since divestiture has taken place not through alterations in existing tariffs but, rather, through the introduction of new service/pricing options. And, here leadership has been even less prevalent. Thus, the evidence provided by observed pricing behavior is inconsistent with anticompetitive price leadership.

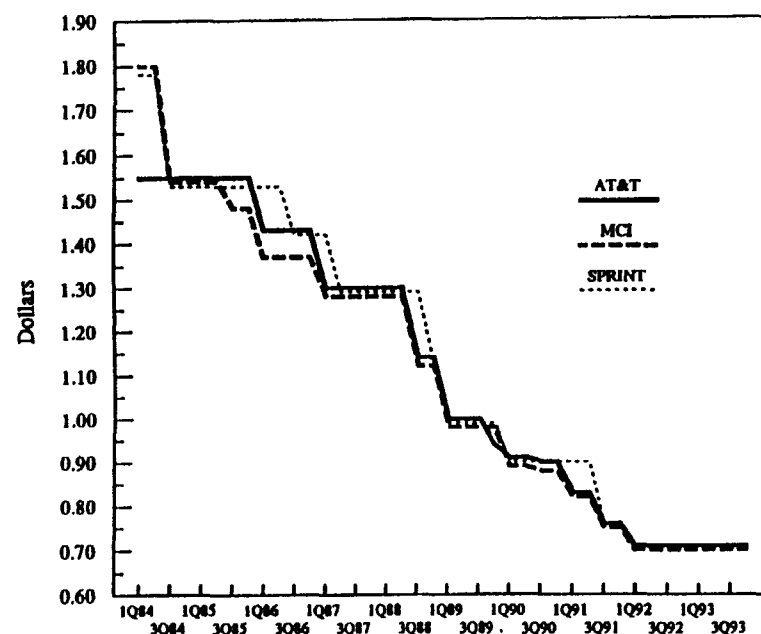


Figure 4. California Intrastate Rate Comparison (5-Minute, 100-Mile Day Call)

Source: Tariff filings. California Public Utility Commission

Finally, the propensity of firms to innovate and introduce new products or services constitutes another important element of industry conduct. In this regard, the interexchange industry has provided a host of positive developments. New services and quality improvements have resulted from significant technological change (e.g., fiber deployment). Such change has led to improvements in the quality of service and creative tailoring of services to customer needs through a proliferation of new service offerings and pricing options (e.g., MCI's Friends and Family). Technological advances have also markedly improved the clarity of calling and reduced blocking rates on long-distance calling over the past decade. Finally active long-distance firms have been rapidly introducing new services into the marketplace. At least two features of this new service introduction stand out. First, the number of new services that have appeared is quite large. Virtually all of these services represent new pricing options that enable customers to lower effective prices below the standard tariff rates. Consequently, the process of new service introduction represents an important vehicle for price competition in this industry; and that competition has been active.¹³ Second, the leap-frogging manner in which interexchange companies have introduced new services belies the notion that any one company acts as a consistent leader in the pushing the pace of industry competition.

Overall, then, the traditional indicia of market conduct suggest an industry that is subject to effective competition. Substantial investment programs, aggressive and relatively informative advertising, uncoordinated pricing of an increasingly homogeneous product, and a highly innovative process of new service introductions all point to a healthy and vigorous rivalry between the firms in this market. Thus, the post-divestiture realizations of conduct are consistent with the sort of expectations that one would tend to form on the basis of the structural characteristics described earlier.

3.3. Performance

As noted in Section 2 above, the structural separation of AT&T in 1984 gave rise to a number of concerns about the ultimate performance of the long-distance industry in the post-divestiture period. Of primary importance from a public policy perspective, these questions centered on the price and quality performance of the industry.¹⁴ The past ten years of experience has served to substantially relieve that

anxiety for most observers. This experience has shown that, for the most part, consumers have benefitted considerably from the divestiture and subsequent developments in the telecommunications industry.¹⁵

These benefits can be seen graphically in figure 5, which shows a comparison of the CPI for all goods and services and the CPI for all telephone services (including local exchange service). There, we see that, in the period immediately following divestiture, the CPI for all telephone services rose more rapidly than the overall CPI but has subsequently shown nominal prices that are generally flat (decreasing real prices). A more focused look at long-distance prices, shown in figure 6, reveals that both interstate and intrastate toll prices have fallen considerably both in nominal and real terms since the divestiture.

While the aggregate CPI price data provide a view of the overall movement of telephone prices, a more readily digestible assessment of price changes for long-distance service is provided in table 2. There, we see the price changes that occurred

Table 2. Prices For Long Distance Calls			
(Selected City-Pairs, AT&T 5-Minute, Daytime)			
	January 1984	February 1993	Percentage Change
New York, NY - San Francisco, CA	\$2.70	\$1.25	-53.7
Washington, DC - Baltimore, MD	\$1.60	\$1.10	-31.3
Chicago, IL - St. Louis, MO	\$2.14	\$1.15	-46.3
Dallas, TX - Denver, CO	\$2.34	\$1.15	-50.9
Boston, MA - Miami, FL	\$2.40	\$1.20	-50.0
New Orleans, LA - Houston, TX	\$2.27	\$1.15	-49.3
Charlotte, NC - Columbia, SC	\$2.05	\$1.15	-43.9
Source: <i>Trends in Telephone Service</i> , Industry Analysis Division, Federal Communications Commission, March 1993.			

between January 1984 and February 1993 for a sample of specific routes. For a 5-minute daytime call, nominal prices have fallen significantly over the past decade, typically by about 50 percent.

Aggregate price indices provide a good first pass at understanding the benefits realized by consumers in the post-divestiture period. There are, however, several

13 This tendency for firms to implement price changes through new service offerings (as opposed to tariff changes) also reduces the likelihood that a successful collusive agreement could be forged in this industry.

14 While rate design issues evoked considerable controversy in regulatory circles prior to the AT&T divestiture, (e.g., the debate over TELPAK rates was protracted and intense), the overall level of telephone prices was not a topic that generated a great deal of attention. Between 1935 and 1992, the Consumer Price Index (CPI) rose by an average of 4.2 percent annually. In contrast, the CPI for telephone services rose by a modest 2.1 percent annually over this same period. In light of these price changes, the lack of controversy over telephone

price levels prior to divestiture is probably best understood in the context of Joskow's (1974) paper which argued that as long as overall rates of a utility's service were constant or falling, the most likely regulatory action is inaction.

15 A notable exception has been the pricing of long-distance operator services by alternative operator service (AOS) providers who contract with hotels, hospitals, and similar facilities to provide long-distance services for individuals at these institutions. On occasion, these firms have been known to charge rates that are several times the levels of the traditional long-distance firms. Their ability to do so, of course, stems from the unique spatial monopoly power held by the hotel, hospital, etc., over access to the long-distance network.

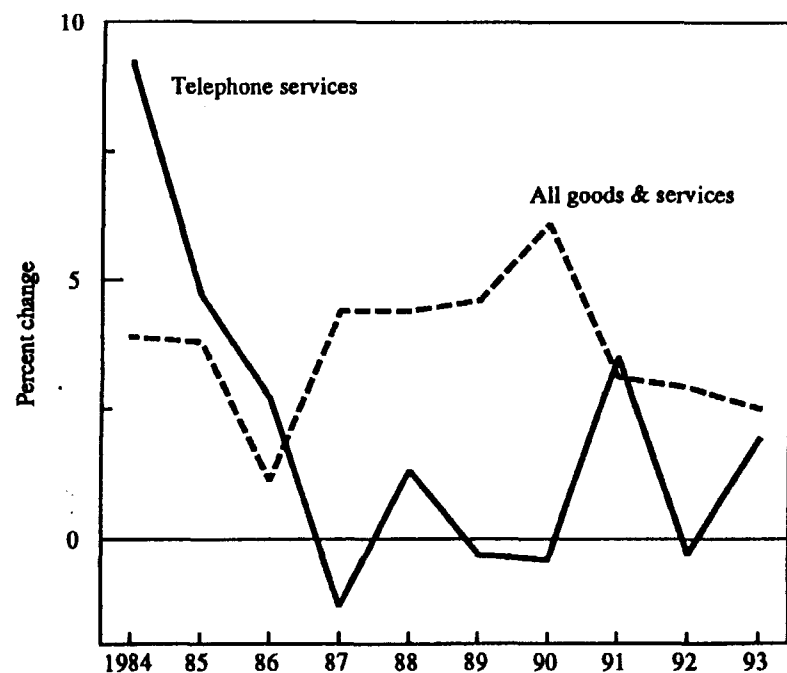


Figure 5. Telephone Price Changes Since Divestiture

Source: Trends in Telephone Service, Industry Analysis Division, Federal Communications Commission, May 1994.

reasons to believe that the CPI-based measures seriously understate these benefits. First, the CPI is a fixed-basket (Laspeyres) index and, consequently, fails to account for changes in the mix of consumption due to relative price changes. The changing price of long-distance service relative to local service together with vastly different demand elasticities for these services have led to dramatic increases in the amount of long-distance calling in the past ten years relative to local usage. The CPI-based measures of telephone prices fail to account for this changing mix of consumption and, therefore, understate the benefits to consumers from their higher consumption of long-distance services at lower prices.

Second, the reported price data are based upon tariff filings (i.e., list prices) and, therefore, fail to account for innovations in pricing that have occurred which better allow consumers to tailor their telephone service to their particular needs. This tailoring of consumer services that is now available through a variety of self-selecting pricing plans means that fixed comparisons like those shown in table 2 are a lower bound on the benefits that long-distance consumers have received.¹⁶ And finally, the data fail to account for the widespread growth of lifeline subscriber plans that reduce considerably the expenditures necessary to connect to the tele-

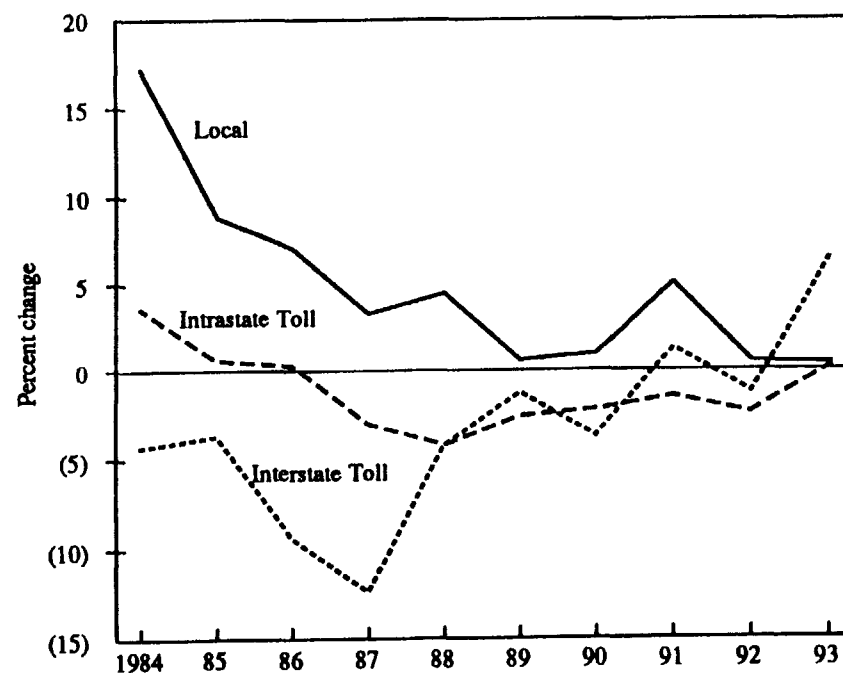


Figure 6. Post-Divestiture Telephone Price Changes

Source: Trends in Telephone Service, Industry Analysis Division, Federal Communications Commission, May 1994.

communications network.¹⁷ Of course, it is not easy to untangle the individual contributions of technology, competition, and regulatory reform in causing the favorable movement in prices.¹⁸ In all likelihood, it is a combination of all three

16 This observation is similar to those made regarding the pricing developments in airline and railroad service following deregulation of these industries. For instance, it has been pointed out that it makes increasingly less sense to compare the price of a full fare airline ticket for travel between two cities when roughly 90 percent of all passengers fly at discounted fares.

17 Between 1985 and 1992, 35 states implemented lifeline assistance plans for low-income subscribers. While the details of these plans vary from state to state, they typically offer low-income households a reduced monthly payment for ongoing subscription to the telecommunications network. Also, 48 states now offer assistance to low-income consumers for the installation charges associated with initially subscribing to the telecommunications network. See Federal Communications Commission (1993).

18 In a recent study of interstate long-distance prices Taylor and Taylor (1993) argue that long-distance price reductions have been primarily driven by access charge reductions. Their analysis, which is based upon CPI price data for telephone services, is subject to all of the caveats noted above.

factors.

In conclusion, an investigation of the evolution of structure, conduct, and performance in the interexchange industry in the decade following the divestiture of AT&T provides considerable reassurance that Judge Greene's goal of creating a "truly competitive industry" has been realized and that the fears expressed in the early 1980s were, in fact, misplaced.¹⁹ The industry has not evolved back toward monopoly; there has not been a mass exodus of smaller firms; there is no indication of tacit collusion, coordinated pricing behavior, or predatory pricing; actual prices have fallen considerably; and neither local rates nor universal service have suffered any apparent harm. Thus, the Competition Advocates appear to have won the forecasting contest.

4. Regulatory Responses

Prior to the divestiture of AT&T, the Bell System was pervasively regulated.²⁰ With divestiture, Judge Greene sought to establish the foundation for a "truly competitive telecommunications industry." In particular, the goal of the divestiture was to separate that portion of the industry that was thought to still possess monopoly characteristics (i.e., local exchange service) from that portion of the industry wherein it was believed competition could thrive (long-distance). Judge Greene clearly felt that the divestiture agreement would result in the elimination of any monopoly power previously held by AT&T. Specifically, he wrote: "Once AT&T is divested of the local Operating Companies...it will be unable to subsidize the prices of interexchange service with revenues from local exchange service or to shift costs to competitive interexchange services." In light of this, the court concluded that "With the removal of these barriers to competition, AT&T should be unable to engage in monopoly pricing in any market."²¹

Despite Judge Greene's optimistic outlook for competition in the long-distance marketplace, the act of divestiture itself did *not* result in any deregulation of the long-distance industry whatsoever. Instead, AT&T simply inherited the same regulatory structure it had faced prior to divestiture. While there was some initial discussion at the FCC of an early deregulation of AT&T, these talks quickly gave way to a more "studied approach." Indeed, it was not until 1989 that the FCC eliminated rate-of-return regulation of AT&T. And at that time, the Commission still refrained from outright deregulation, choosing instead to implement a Price Cap plan for AT&T that was modeled after the regulatory structure used in England to regulate British Telecom (a monopoly). Under this plan, the Commission

19 While this conclusion appears to be the growing consensus among economists who have examined the long-distance industry (e.g., Porter (1993), Hall (1993), Ward (1993), and Kahai, Kaserman, and Mayo (1994)), there are dissenters. See, for example, Hausman (1993).

20 As noted above, it still is, though somewhat less so.

21 *United States v. AT&T*, 48 PUR4th 227, 552 F. Supp. at 172 (D.D.C. 1982).

established price caps for specific services above which AT&T could not raise prices without explicit Commission approval. Below the caps, however, AT&T is free to price flexibly, raising or lowering prices to reflect market conditions.

In addition to the ongoing regulation of AT&T's interstate services, each state, through its public utility commission, maintains regulatory authority over intrastate long-distance calling. In general, the states have moved much more quickly and aggressively than the FCC to eliminate traditional public utility regulation.²² For example, in mid-1984, on the heels of the divestiture, Virginia's public utility commission announced that it was eliminating rate-of-return regulation and granting full pricing flexibility to AT&T for intrastate interLATA toll services. Since that time, most states have implemented reduced regulatory controls for the interexchange industry in general, and AT&T in particular.

Aside from the obvious policy interest in the evolution of competition and pricing for long-distance services discussed in Section 3, industrial organization economists have taken advantage of the divestiture to shed new light on both the causes and consequences of observed regulatory policies. Of particular importance, while pre-divestiture regulatory policy dealt with the monolithic Bell System, post-divestiture regulators now deal at both the state and interstate level with a host of long-distance providers. Moreover, while regulation of the post-divestiture AT&T began on essentially similar ground across the states, the individual jurisdictions have now had ten years to forge their own trails, and many of these have gone in different directions.

This widespread policy experimentation by the individual states has both broad social value and a related but more basic scientific value to economists. The potential social benefits of this sort of state-level experimentation were pointed out by Justice Brandeis who, writing for the Supreme Court over 50 years ago said, "There must be power in the states...to remold, though experimentation, our economic practices and institutions to meet changing social and economic needs....It is one of the happy incidents of the federal system that a single courageous state may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country."²³ Moreover, the resulting variation in regulatory policies has also created a fertile field for cross-sectional, and, increasingly, time series empirical analyses by economists on the causes and consequences of alternative regulatory regimes. In the paragraphs that follow, we survey the emerging literature pertaining to three key areas of empirical research involving the post-divestiture long-distance industry.

4.1. Rate of Return Regulation

Following the divestiture and the growth of competition in the interstate and intrastate interexchange toll markets, economists began to argue that conditions

22 See Kaserman and Mayo (1990).

23 *New State Ice Co. v. Liebman* 285 U.S. 262, 311 (1936).

were right to eliminate rate-of-return and other direct forms of price regulation as a policy tool in the long-distance industry.²⁴ After all, such regulation was initially designed to deal with the problem of market failure due to the presence of natural monopoly. In the past 30 years, however, a variety of legal, technological, market, and regulatory changes have profoundly affected the ability of long-distance telecommunications markets to support competition. While evidence regarding the existence of natural monopoly conditions in the pre-divestiture Bell System is mixed,²⁵ the general consensus is that such conditions have been eroded in a number of telecommunications sectors. The demise of natural monopoly conditions is most apparent in the markets for equipment manufacturing, customer premises equipment (CPE), and long-distance services.

While the equipment and CPE markets are no longer subject to regulation, the demise of natural monopoly conditions in the long-distance industry did not precipitate the rapid movement to deregulation that many observers had expected at the time of divestiture.²⁶ Nonetheless, while complete deregulation of long-distance services has not materialized in any jurisdiction, a substantial amount of experimentation with various forms of reduced regulation has occurred at the state level. The divergent pace and paths of state-level regulatory policies create opportunities for a least two promising avenues of research. First, given that some states began the deregulation process in 1984 while others remain rate-of-return regulated today, it is feasible to empirically examine the impact that continued rate-of-return regulation has had in a non-natural monopoly setting. The first study to address this issue was conducted by Mathios and Rogers (1989). In their paper, these authors utilized state-level data from 1983-1987 to examine the effect of state-to-state variations in regulatory policies on long-distance prices in 1987. Price data for ten mileage bands were gathered for 39 multiLATA states. Along with the price data, information on a host of demographic characteristics (e.g., population density, per capita income, and the ratio of rural to urban consumers), and regulatory variables (e.g., whether a state allowed pricing flexibility by AT&T on its long-distance services) were also gathered.

Mathios and Rogers first computed descriptive statistics on observed price levels in states with and without pricing flexibility. They found that "[S]tates that allowed pricing flexibility had lower 1987 prices than other states for all mileage bands." They then estimated a reduced form long-distance price equation, which included the demographic variables, a cost (access rate changes) variable, and regulatory variables to account for, *inter alia*, the impact of a regulatory regime shift on prices. The results indicate that "the price of a five-minute call, on average, is 7.2 percent lower in states that allow pricing flexibility." They also attempted to discriminate between the various types of regulatory pricing flexibility. Specifically, they

differentiated between states that allowed full pricing flexibility and states that limited such flexibility through application of price bands. Interestingly, on this matter, the authors report that "... results show that while both of these types of flexibility result in prices lower than in states which allow no flexibility, the pricing-band flexibility results in even lower prices than the full pricing-flexibility framework."

A second research effort to address the issue of the impact of alternative regulatory regimes on pricing in the long-distance industry has been conducted by Kaestner and Kahn (1990). These authors utilize a general oligopoly model to derive a reduced-form estimating equation for the price of AT&T's intrastate long-distance service. In particular, they show that AT&T's price is likely to depend upon (1) access charge levels, (2) the state-specific regulatory regime, (3) the market share of rivals, and (4) other state-specific variables that affect cost or demand. Because the market share of rivals may be simultaneously and adversely affected by the state-specific price, Kaestner and Kahn construct a separate market share equation for AT&T's rivals.

Using data gathered from forty states for each of three years (1986-1988), the two equations are then estimated as a simultaneous system. Two different variables are used to capture the state-specific regulatory regimes. First, they use a measure of the longevity of pricing flexibility in the state. Second, they use a measure of the longevity of deregulation (i.e., elimination of rate-of-return regulation). The results of their estimation reveal that both pricing flexibility and elimination of rate-of-return regulation have had the effect of reducing long-distance prices at the state level. Moreover, they find that the longer that such regulatory reform policies have been in place, the lower the price of long-distance service in that state.

In addition, they find that: (1) the market share of AT&T's rivals is highly responsive to AT&T's price; and (2) the price charged by AT&T is unresponsive to the market share of its rivals. The former result strongly suggests that the price elasticity of fringe firm supply is large in this market which, in turn, suggests that AT&T holds little or no market power. The latter result (that AT&T's price is unresponsive to the share of its rivals) is consistent with both oligopoly pricing in a dominant firm competitive fringe industry where the elasticity of supply of the competitive fringe is very high²⁷ and (equivalently) contestability theory.²⁸

Another avenue of research made available by the divergent paths the states have followed in their movement to reduce pricing controls in the long-distance industry stems from the desire to refine and test positive economic theories of regulation.²⁹ In this context, it is natural to ask why a particular regulatory outcome is observed in one state but not in another. More scientifically stated, how accurately do the

24 One of the earliest appeals for deregulation was Katz and Willig (1983).

25 See Evans and Heckman (1984) and Roller (1990).

26 See Kaserman, Mayo, and Pacey (1993) for a discussion.

27 See Landes and Posner (1981) and Kaserman and Mayo (1990).

28 See Baumol, Panzar, and Willig (1988).

29 This vein of research goes back to the seminal work of Stigler (1971), Posner (1974), and Peltzman (1976).

various competing theories of regulation predict the different regulatory outcomes observed across the states since divestiture?

This question has been addressed by Kaserman, Mayo, and Pacey (1993), who test the performance of the economic theory of regulation against the public interest theory of regulation to explain this phenomenon. Specifically, they model the decision to eliminate rate-of-return regulation using a set of variables suggested by the economic theory of regulation and an alternative set of variables suggested by the public interest theory of regulation.³⁰ The former set of variables represent the strengths and stakes of the more important interest groups that are directly influenced by the decision to deregulate. In contrast, the variables suggested by the public interest theory of regulation relate more closely to the expected impact of deregulation on overall social welfare.

Given the binary nature of the decision to deregulate, the model was estimated using a logit model. In general, the results show that the variables suggested by the economic theory of regulation perform quite well in explaining the cross-sectional variation in states' decisions to "deregulate." Of particular interest, it was found that two previously neglected interest groups have played a significant role in the state-level decisions to eliminate rate-of-return regulation. First, the size and structure of the public utility commission staff played a key role in the ultimate decision to deregulate the long-distance industry. Second, public utility commissions' decisions to deregulate are significantly influenced by signals sent by state legislatures.³¹ This later finding reinforces the growing recognition of the importance of congressional oversight bodies in determining regulatory outcomes.³² In sharp contrast to the generally significant influence of the variables suggested by the economic theory of regulation, the public interest theory variables failed to add significant explanatory power to the model. Collectively, then, the model points toward the usefulness of using the economic theory of regulation as a general guidepost in attempting to understand regulatory outcomes.

4.2. IntraLATA Competition

As with the case of relaxing interLATA regulations, individual states have also moved at different speeds to allow the introduction of intraLATA toll competition by interexchange carriers. The resulting diversity of regulatory policies pertaining to entry into this market provides a natural social experiment to examine the economic consequences that have stemmed from the decision to open the LATAs to toll competition by interexchange carriers. Two questions are of particular interest. First, what has been the effect of allowing intraLATA toll competition on

the long-distance rates charged by the local exchange companies whose services are then subjected to competition? Mathios and Rogers (1990) examine this issue using data on 1986 intraLATA toll prices in the lower 48 states. Employing a reduced-form pricing equation to estimate the effect of allowing competition on toll prices, they find that prices in states that prohibit intraLATA toll competition are roughly 7.5 percent higher than in states that permit this form of competition.³³

While it is perhaps not too surprising that intraLATA toll rates have fallen with the introduction of competition, a second, more subtle, question has also arisen regarding this issue. Specifically, it has been feared that opening the LATAs to competition may lead to reduced profitability of the local exchange company and, thereby, result in the need to raise local rates. Kaserman, Mayo, Blank, and Kahai (1994) address this question both from a theoretical and empirical perspective. Using a residual pricing model, they find that, under certain assumed conditions, the introduction of intraLATA toll competition will theoretically lead to *lower* local rates. To the extent that these conditions do not hold, however, the impact of the introduction of intraLATA toll competition on local rates is theoretically indeterminate.

Accordingly, they then turn to examine the issue empirically. A model of the determinants of local residential telephone rates is constructed and estimated. Both the existence and longevity of intraLATA competition is included in the model, along with a variety of other "standardizing" variables. The results indicate that the introduction of intraLATA toll competition has had no significant impact (either positive or negative) on the rates charged to local residential rate payers.³⁴

Thus, the empirical literature suggests that a policy of open entry into intraLATA toll markets is unambiguously beneficial. Toll rates are reduced, and local rates are unaffected. As a result, some consumers gain while no consumers lose. Competition appears to be as viable in intraLATA toll markets as it has proven to be in the interLATA market.

4.3. Price Caps

Over the years, there has been a growing recognition by economists of the inherent incentive problems created by traditional rate-of-return regulation.³⁵ This increasing skepticism of rate-of-return regulation, together with the adoption of a price-cap regulation mechanism for various telecommunications firms, has generated considerable interest in assessing the economic consequences of this latter form of regulation.³⁶ At the most intuitive level, the appeal of price-cap regulation

30 For a more complete explanation and comparison of these theories, see Posner (1974).

31 At the state level, these signals are often sent through "enabling" legislation that expressly permits the PUC to relax regulations or deregulate if it finds that such a policy is consistent with the public interest.

32 See Weingast and Moran (1983) for the seminal research in this area.

33 In the context of a generalized dominant firm/competitive fringe model of intraLATA toll pricing, Blank, Kaserman, and Mayo (1994) find similar results.

34 This result is consistent with the earlier analysis of this issue by Seviens (1991) and Kaestner and Kahn (1992).

35 For a survey of the pertinent literature, see Sherman (1989).

36 The first major adoption of price-cap regulation was British Telecom in the early 1980s. Subsequently, price-cap regulation has been adopted in the United States by the FCC for

is twofold. First, in contrast to rate-of-return regulation, which is essentially a cost-plus form of regulation, price caps divorce firm prices from costs. This uncoupling of prices and costs presumably creates incentives for the regulated firm to produce more efficiently and to innovate more aggressively.³⁷ Second, given that prices are set initially by regulators and cannot be raised except by various adjustment formula that are acceptable to regulators, the fear of monopoly pricing is also attenuated under this system.

The interest in price-cap regulation has spawned a host of theoretical research over the past decade. A complete survey of that literature is beyond the scope of this paper.³⁸ It is worth pointing out, however, that this literature generally assumes the presence of significant monopoly power on the part of the regulated firm for at least some subset of its products.³⁹ Consequently, if one believes (as we do) that effective competition is currently present throughout the long-distance (inter-LATA) market, price-cap regulation and the theoretical literature pertaining to it has little, if any, relevance to this portion of the telecommunications industry. It may, however, be applicable to the situation now faced by the LECs, where some services remain subject to monopoly supply while other services are experiencing emerging competition.

While the theoretical properties of price-cap regulation of partial monopolists have been considered in some depth, its empirical consequences have not yet been thoroughly explored.⁴⁰ As a result, there is insufficient evidence at this point to reach any sort of firm conclusion regarding the relative performance of firms subjected to this form of regulation. We simply do not now know whether price-cap regulation will ultimately prove to be superior to rate-of-return regulation or the various other incentive regulation mechanisms currently being implemented. What we do know, however, is that, in the presence of effective competition, complete deregulation is, in all likelihood, the superior policy choice.

AT&T's interstate services and for the Regional Bell Operating Companies for interstate access services.

37 See Cabral and Riordan (1989). For a more critical perspective of the theoretical performance properties of price caps relative to rate-of-return regulation, see Liston (1993). See also Abbott and Crew (1993).

38 Liston (1993) contains a detailed discussion of the theoretical properties of price-cap regulation, as well as a thorough bibliography.

39 For example, Sappington and Sibley (1992, 3) write that: "AT&T is thought to have considerable market power over services in the first two baskets..."

40 In the only such study of which we are aware, Schmalensee and Rohlfs (1992) attempt to estimate the consequences of FCC price-cap regulation of AT&T. They estimate that in the price cap period from 1989-1991, the productivity gains from AT&T's efforts to reduce costs and increase efficiencies were \$1.8 billion. Also, see our earlier discussion of Mathios and Rogers (1989).

5. Conclusions, Policy Issues, and Emerging Areas of Research

The past decade has witnessed a remarkable transformation of the long-distance telecommunications industry. What began as a completely untested proposition—that competition for long-distance services is a sustainable phenomenon—has now been established as an uncontested fact. There are roughly 400 long-distance carriers operating in the United States today. While AT&T is still the largest firm in the market, its competitors have shown a remarkable ability to enter, grow, drive the market by introducing new services, and enforce competitive discipline in the market. The combination of these competitive pressures, technological changes, and regulatory responses have yielded substantial benefits to consumers in the form of lower prices and a vastly expanded array of new services from which to choose.

The past decade has also provided economists with a rare opportunity to examine both the causes and consequences of alternative regulatory policies. Several empirical studies have now been performed on the consequences of different regulatory policies in the post-divestiture period. These tests strongly support the proposition that public utility-style, rate-of-return regulation has served to elevate prices for long-distance service. The conversion of regulation to a price-cap mechanism has been shown to improve productivity considerably relative to rate-of-return regulation. The empirical estimates to date, however, suggest that the greatest gain to long-distance consumers will occur when all direct regulatory controls on price levels are eliminated.

Empirical research has also shown that competition for intraLATA services has generated benefits to long-distance consumers and has not resulted in any upward movement in local residential telephone rates. The disparate evolution of post-divestiture regulatory policies at the state level has also given rise to the opportunity to examine the causes of observed regulatory policy. Empirical tests suggest that the current pattern of long-distance regulation is best understood from the perspective of the modern economic theory of regulation.

While the first decade of the post-divestiture telecommunications industry has stimulated a spate of important empirical research, the next decade promises to be equally interesting. A number of important economic and policy issues now lie on the horizon. Economic research in these areas holds the promise of shedding new light on outstanding unresolved economic issues as well as providing policy guidance for federal and state legislative and regulatory bodies. Some of these issues include: (1) the impact of "1+" competition in intraLATA toll markets; (2) how market behavior may be affected by the post-deregulation threat of reregulation; (3) the causes and consequences of the variations in the size of local calling areas; (4) economic assessments of price caps versus complete deregulation of long-distance services; (5) the economics of alternative approaches to regulating the local exchange carriers; and (6) the economic consequences of possible BOC re-entry into interexchange services and equipment manufacturing. The one thing of which we can be certain is that there will be no shortage of interesting and policy-relevant issues to investigate.

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**DRAFT: DO NOT QUOTE
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**Targeted and Untargeted Subsidy Schemes:
Evidence from Post-Divestiture Efforts to Promote Universal Telephone Service**

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March 1995

* The authors would like to thank Bill Fox, Darlene Hannon, Stephen Mayo, and Pat Parker for helpful discussions in the formulation of this paper. The usual caveat applies.

TARGETED AND UNTARGETED SUBSIDY SCHEMES: EVIDENCE FROM POST-DIVESTITURE EFFORTS TO PROMOTE UNIVERSAL TELEPHONE SERVICE

I. Introduction

In the absence of a significant market failure, the central normative message of microeconomics is that prices should generally be established at their respective marginal costs. In regulated industries, however, cross-subsidization policies often lead to prices that deviate systematically from these prescribed levels. Such deviations also occur in non-regulated industries where, for any of a variety of reasons, subsidization policies are put in place. These policies include a variety of in-kind transfer payments (e.g., food stamps and housing subsidies) and overt subsidies (e.g., agricultural subsidies). Where such subsidies occur, economists have long advocated targeting those subsidy flows in a way that minimizes the total amount of allocative inefficiency caused by non-marginal cost pricing.¹

In particular, it has been argued that failure to target subsidy recipients is economically wasteful in at least two respects. First such failure means that some individuals who do not "need" the subsidy to achieve the desired policy goal are unnecessary recipients. From a policy perspective, this is pure waste because the explicit or implicit expenditure on the untargeted individual fails to promote the desired end. Second, because failure to target the subsidy increases the amount of funds required to obtain a given effect, it also magnifies the economic

¹See, for example, Kahn (1984), Kaserman and Mayo (1994), and Hausman (1994).

distortions created in the sector generating these funds. If, for instance, tax revenues are the source of the financing, untargeted subsidies require higher levels of taxation than is necessary to achieve the desired policy objective. If, alternatively, the subsidy is financed through distortionary pricing of a related good or service, then the allocative inefficiencies imposed on these goods or services are, again, higher than necessary.

Despite repeated calls by economists for the targeting of subsidies, a variety of untargeted subsidy mechanisms remain in place. The perpetuation of such untargeted subsidy flows may be attributable to a variety of factors. For instance, untargeted subsidies may stem from the political benefits that are thought to be forthcoming as a result.² Alternatively, it is possible that the perpetuation of untargeted subsidy schemes is, at least in part, a consequence of the lack of quantitative evidence regarding the relative benefits or effectiveness of targeted versus untargeted subsidy schemes. Indeed, while calls by economists for targeted subsidy flows are common, empirical evidence of the relative effectiveness of such schemes relative to more broadly-based subsidy flows is scarce.³

This lack of empirical evidence stems in part from the fact that situations that lend themselves to such testing do not commonly arise. In this paper, however, we have identified a large scale set of targeted and untargeted subsidy flows that have developed over the past decade that exist side by side, each with the same nominal policy goal--promoting universal telephone

²The notion that the benefits of regulation may be used for the political gain of policy makers dates back to the seminal work of Stigler (1971), Posner (1971, 1974), and Peltzman (1976).

³A comparative analysis of the efficacy of alternative subsidized housing programs is found in Mayo (1986).

service. As a consequence, we are able to test empirically the relative contribution of the alternative subsidy mechanisms in promoting the policy goal of maximizing residential subscription to the public switched telephone network.

The paper proceeds as follows. First, in Section II we provide a background discussion of the evolution of telecommunications pricing and the policy instruments that have been adopted to promote universal service. Next, in Section III, we turn briefly to a conceptual model of the demand for access to the telecommunications network. Section IV, then, provides a discussion of the data and an empirical model of household subscription to the public switched telephone network. Of particular importance, the empirical subscribership demand model accounts for the direct and indirect subsidy flows of three public policy programs that have been designed to promote universal service. Section V provides the estimation methodology and results. Finally, Section VI concludes the paper.

II. Background

The Communications Act of 1934 codified the already-existing policy goal to promote universal telephone service in the United States. Over time, that goal has assumed increasing importance, becoming a, if not the, predominant consideration in virtually all policy debates surrounding this industry. Universal service has, in fact, been labeled the Holy Grail of telecommunications policy.

The primary policy instrument used to pursue this goal has been the practice of pricing customer access to the telecommunications network and local usage on a bundled, flat-rate basis at less than the marginal cost of providing these combined services. The financing for this

below-cost pricing has historically been generated by pricing long-distance services well in excess of their incremental cost. Under this pricing policy, the proportion of households that subscribe to the telecommunications network (i.e. household penetration) has risen to nearly 94 percent today. While the degree of household penetration has risen, however, it has not been without cost. For example, Griffen (1982) estimates that the welfare losses associated with this pricing structure were roughly \$1.5 billion annually. Others have placed even higher welfare losses on these pricing distortions.⁴ Despite these costs, however, this system of pricing remains politically popular and shows few signs of serious reform.⁵

In the 1980s, two major policy changes prompted heightened concerns about the achievement and maintenance of universal service in the United States. First, the divestiture of AT&T from the Bell operating companies gave rise to a concern that the introduction of competition in the long-distance industry would lead to an end to the historical cross-subsidization of telecommunications access and local usage. While this fear was logically misplaced,⁶ it nonetheless, gave rise to new policy initiatives to promote universal service. Second, in an effort to improve the efficiency of telecommunications pricing policies, the Federal Communications Commission (FCC) initiated an End-User Access Charge Plan in January of 1984. This Plan, which was designed to bring telephone prices for local and long-distance

⁴See Wenders and Egan (1986).

⁵Kahn (1984, p.153) writes that "However much they may be required for economic efficiency, justified by the non-traffic-sensitivity of access costs, and compelled by the pressures of competition, increases in the basic monthly rate are political poison."

⁶See Kaserman and Mayo (1994).

services closer to their economic cost, shifted part of the responsibility for covering the costs of providing access to customers. This was done through the imposition of an explicit subscriber line charge (SLC). Initially, this charge was set at \$1.00 for residential customers and has, over time, grown to \$3.50 per month per line. Because this charge effectively increased the price of flat-rate local telephone service, it gave rise to considerable concern over the commitment by telephone policymakers to the goal of universal service.⁷

As a result of these increased concerns over universal service, the FCC instigated three new policy initiatives designed to promote telephone subscribership. First, the FCC implemented, through the Joint-Board, a joint federal and state effort to target certain households for specific telephone subsidies. This program, labeled the Lifeline plan, was first initiated in December 1984 and was subsequently modified to take on its current form in December 1985. Under this plan, eligible households are entitled to receive a waiver of the FCC-imposed SLC provided that the state match the federal reduction in the household's monthly telephone bill. Thus, for eligible households that currently participate in the Lifeline Plan, the monthly recurring telephone bill may be reduced by up to \$7.00. Eligibility criteria were left to the individual states but were subject to approval by the FCC.⁸

Second, the FCC also implemented the Link-Up plan. Like the Lifeline plan, this plan is a targeted program designed to subsidize those households that are considered to be at risk of

⁷For instance, legislation to overturn the plan passed the U.S. House of Representatives in late 1983. Similar legislation was heavily debated in the Senate but ultimately failed.

⁸Typical eligibility requirements include eligibility for food stamps, SSI, or Medicaid. For a complete listing of the state-by-state eligibility criteria, see Federal-State Joint Board (1994).

dropping off the public switched network in the absence of a subsidy. Unlike the Lifeline plan that provides for subsidization of the monthly recurring charges for subscription to the telephone network, however, the Link-Up plan provides a one-time subsidy for the expenses associated with initial subscription to the network. That is, it was felt that the initial installation charges imposed by local exchange companies (LECs) may prove to be a deterrent to subscription for certain low-income households. Accordingly, the FCC adopted a two-part subsidy to ease the burden associated with installation charges. First, for eligible households, federal subsidies will provide up to one-half of the initial installation charges associated with subscription to the public switched network, up to a maximum of \$30.00 per household. Second, federal assistance is provided to defer the interest expenses associated with spreading the initial installation fees over a period up to 12 months.

Importantly, both the Lifeline and Link-Up plans are financed from charges imposed on interexchange carriers, and, therefore, on interexchange calling. Specifically, after state programs are certified by the FCC, participating LECs are reimbursed through the National Exchange Carriers Association (NECA) based on expenses submitted to the NECA by the LECs. NECA then collects the requisite subsidies from interexchange carriers based on their market shares of presubscribed customers.

Both the Lifeline and Link-Up programs have grown rapidly since their inception. Thirty-three of the forty-eight contiguous states have adopted the Lifeline plan, and forty-six states have adopted the Link-Up plan. By 1993, there were 3.8 million Lifeline participants and roughly 740 thousand Link-Up participants.

The third program implemented to promote universal service in the post-divestiture

telecommunication industry is the High Cost Assistance program. Unlike the targeted approach of subsidizing *households* that was adopted in the Lifeline and Link-Up plans, the High Cost Assistance program creates a Universal Service Fund (USF) for reimbursing high-cost *companies*. Specifically, under the High Cost Assistance program, LECs serving mainly rural areas whose costs are higher than the national average are eligible to be reimbursed for a portion of those higher costs. Importantly, the funds reimbursed to these LECs under the High Cost Assistance program are not targeted to households that are at risk of dropping off the network. That is, under this reimbursement mechanism, the subsidy flows to the companies rather than specific households that are identified as being at risk of dropping off the network in the absence of a subsidy. Like the Lifeline and Link-Up plans, funding for High Cost Assistance is also provided through charges imposed on interexchange carriers.

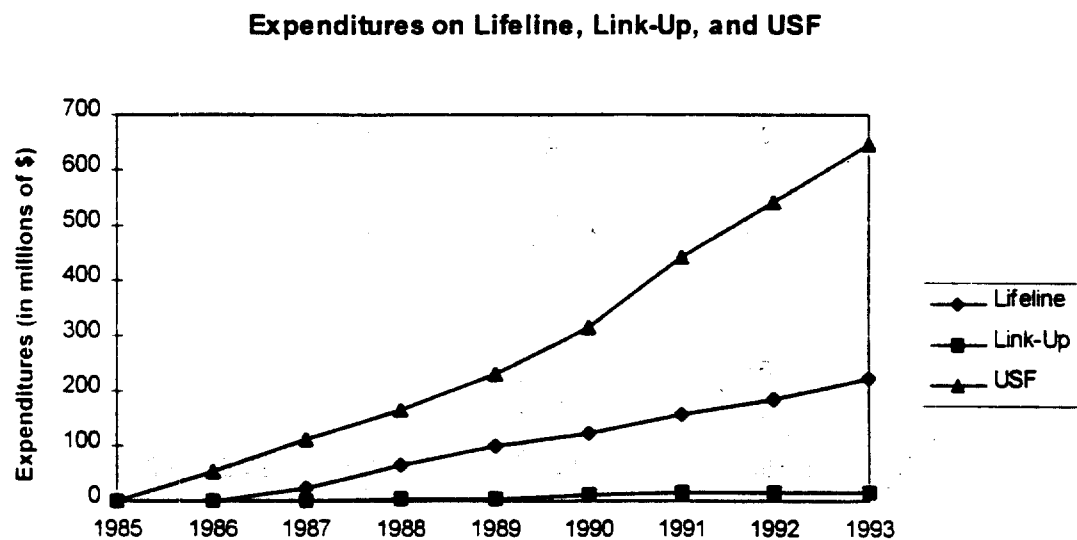


Figure 2

The USF was phased in over an eight year period beginning in 1986 with full funding

scheduled for 1993. The growth of expenditures on the USF has been pronounced. By 1994, the total amount of the subsidy flows under the High Cost Assistance program were nearly three-quarters of a billion dollars. The growth of expenditures on Lifeline, Link-Up, and High Cost Assistance is shown in Figure 1.

The relative merits of these particular policy instruments can be, and have been, debated on theoretical grounds. The ultimate evaluation of these programs, however, involves an empirical evaluation of their realized benefits and costs. Specifically, have the plans had the effect of increasing the degree of universal service? And, if so, how have the plans fared relative to one another in accomplishing this objective?

III. Subscription to the Telephone Network -- Conceptual Considerations

To determine the effectiveness of public policy programs designed to promote universal service, it is necessary to (1) define what is meant by the term universal service, and (2) standardize for the various factors other than the public policy programs that may be having an influence on subscribership levels. On the first matter, we simply define universal service to be a maximization of the percentage of households that have subscribed to the public switched network.⁹ On the second issue, we rely heavily on the extant telecommunications demand

⁹Admittedly, this definition abstracts from the ongoing debate regarding whether the traditional concept of universal service is adequate for the future in a rapidly evolving telecommunications industry. A thorough range of opinions on how the universal service concept may be modified is contained in the October 1994 Comments filed with the FCC in CC Docket No. 80-286 "In the Matter of Amendment of Part 36 of the Commission's Rules and Establishment of a Joint Board."

literature.¹⁰ Specifically, this literature offers a relatively established framework to identify empirically relevant determinants of the demand for subscription to the telecommunications network. Because that literature is well established, we shall only briefly sketch the conceptual foundations of the empirical model.

Consider a household with a weakly separable utility function:

$$(1) \quad U(c, x_a, x_u) = U[c, u(x_a, x_u)] \text{ such that } \frac{\partial(\partial U/\partial x_i)(\partial U/\partial x_j)}{\partial \phi} = 0 \quad \forall i \neq j,$$

where x_a represents access to the telecommunications network, x_u represents telephone usage including both local and long-distance service, c is a vector of all other goods and services, and ϕ is any component of c ¹¹. Given such a utility function, the decision to purchase access to the telephone network is based on an indirect utility function of the form:

$$(2) \quad v = v(p_a, p_u, y, z, \epsilon),$$

where p_a is a vector consisting of the one-time connection charge and the monthly service charge, p_u is a vector of the local usage price (usually zero) and long-distance usage prices, y is income, z is a vector of household characteristics, and ϵ is a random parameter which is independently distributed across households. The decision to purchase access to the network,

¹⁰See for example, Martins-Filho and Mayo (1993), Cain and MacDonald (1991) and Kaserman, Mayo and Flynn (1990). Much of the literature is summarized in Taylor (1994).

¹¹The advantage of assuming a weakly separable utility function is that the influence of other consumer choices on the decision to allocate expenditures between different telecommunications services can be ignored. Specifically, we assume a two-stage optimization problem where, in the first stage, the consumer allocates his expenditures among broad categories (telecommunications services and "other goods and services") and then, in the second stage, allocates expenditures within each category.

being a discrete choice, is made iff

$$(3) \quad v_o(p_u, (y - p_a \cdot x_a), z, \epsilon) \geq v_o(y, z, \epsilon).$$

Clearly, then, the demand for access to the telecommunications network depends, at least in part, upon consumers' underlying demand for usage of that network to place and receive calls. This point can be seen graphically in Figure 2. In panel (b), we represent the demand for usage of two customers as D_A and D_B .¹² For any given price of usage, D_A and D_B represent the quantity of outgoing telephone calls demanded. Thus, for a price P_1 , consumer A will demand q_A and consumer B will demand q_B . For any given amount of calling and price per call, an amount of consumer surplus, CS_A and CS_B is generated for consumers A and B, respectively.

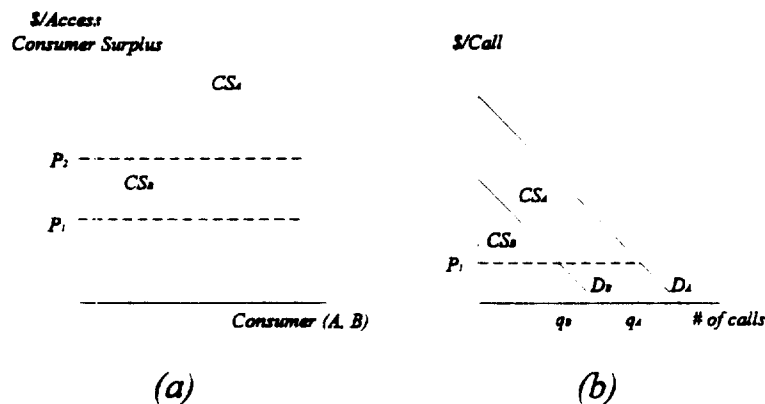


Figure 2

Given the standard pricing schedule of LECs wherein a fixed monthly fee is paid with a

¹²Note that these usage demand curves include both local and long-distance calls. With flat-rate local service, local usage is priced at zero. Long-distance usage, however, has a positive price.

zero marginal price per call, the decision to subscribe or not to subscribe is driven by a comparison of the fixed monthly price of access relative to the amount of consumer surplus generated in the usage demand curve. That is, if the amount of consumer surplus exceeds the fixed price of access, the consumer will subscribe to telephone service; otherwise he will not. For instance, as shown in Figure 2 panel (a), at a price of access of P_1 , both consumers A and B will subscribe to the network. If the price of access is P_2 , however, then individual B's consumer surplus from usage relative to the price of access is insufficient to entice her to subscribe to the network. Thus individual usage demand and the price of usage will influence access demand.

Aggregating across individual consumers, then, it is possible to specify a demand schedule for access at the market level as

$$(4) \quad PR = f(P, S, D, \epsilon),$$

where PR is the percentage of households that subscribe to the telecommunications network, P is a vector of prices that correspond to the price of subscribing to the network (e.g., the price of initial installation and fixed monthly charge for subscription) and the price of long-distance service. S is a vector of variables representing the subsidy efforts to promote universal service, D is a vector of demographic characteristics of the state's population including income, and ϵ is a random disturbance term. Equation (4) provides the theoretical foundation for our empirical model of access demand, to which we now turn.

IV. Subscription to the Telephone Network -- Data and Empirical Model

To construct and estimate an empirical model of the demand for access to the public switched network, we gathered state-level data for the 48 contiguous states for the 1985-1993

period. These data pertain to variables suggested by the access demand model described above. The dependent variable is the proportion of households within a state that subscribe to telephone service. This penetration ratio is obviously bounded by 0 and 1. Accordingly, as described below, it is necessary to utilize econometric estimation techniques that account for the limited dependent variable and the corresponding estimation issues that result.

Among the exogenous demand determinants, the price (P) vector includes IR, the installation rate charged by the Bell operating company (BOC) for initial subscription to the telephone network, and WFR, which is a weighted average of the BOC's monthly recurring charge for unlimited local calling. Also included in the price vector is the price of long-distance calling, LD, which is measured as the average revenue per minute for all long-distance calls by AT&T, by year.¹³

The subsidy (S) vector is comprised of two variables. First, the expenditures on targeted subsidy schemes (Lifeline and Link-Up) for each state from 1984 through 1993 are included. Because the dependent variable is measured as the proportion of households that subscribe to the network, the targeted subsidy expenditures are normalized by the number of households in the state. This normalized variable (ELLU), then, constitutes our measure of the magnitude of the targeted subsidy programs. Second, the expenditures per household for the untargeted Universal Service Fund, by state, from 1985 through 1993 (EUSF) are included as a measure of the

¹³Both a fixed-weight average revenue per minute for AT&T's Basic Schedule 1+ MTS service and, alternatively, the actual revenues per minute for domestic residential long-distance service, excluding calling cards, operator handled and directory assistance (but including the effects of discount calling plans) were utilized. Because no significant differences in our results emerged from these alternative price measures, we report only the former.

magnitude of the untargeted subsidy flows designed to promote universal service.

Finally, the vector (**D**) of characteristics of the state's population is included to standardize for the independent influence of demographic factors on household telephone subscription decisions. Included in this vector are the state's per-capita income (**Y**), the percentage of the state's population that is black (**BL**), the percentage of the state's population that is of Hispanic origin (**HP**), and the percentage of the state's population that resides in rural areas (**RL**).

A complete description of the variables and data sources is included in Table 1, along with some simple descriptive statistics associated with these variables. Also, Table 2 provides a correlation matrix of the variables used in the estimation. Assuming a linear form, the model to be estimated is:

$$(5) \quad PR_{it} = \beta_0 + \beta_1 IR_{it} + \beta_2 WFR_{it} + \beta_3 LD_{it} + \beta_4 ELLU_{it} + \beta_5 EUSF_{it} + \beta_6 Y_{it} + \beta_7 RL_{it} + \beta_8 BL_{it} + \beta_9 HP_{it} + \epsilon_{it}$$

Table-1. Variable Definitions, Descriptive Statistics, and Data Sources				
Variable	Definition	Mean	Standard Deviation	Source
PR	Percent of state's households with a telephone.	92.85	3.20	Federal-State Joint Board. Monitoring Report (1994)
IR	Installation charge for a residential access line not requiring a field visit.	33.13	8.72	NARUC's BOC Exchange Service Telephone Rates
WFR	Weighted average flat rate for single party residential service.	12.74	2.37	NARUC's BOC Exchange Service Telephone Rates
LD1	Fixed weight average revenue per minute for AT&T's Basic Schedule Dial 1+ MTS.	0.147	0.039	AT&T, Internal Document
LD2	Fixed weight average revenue per minute for AT&T's domestic residence basic long-distance excluding calling card, operator handled and directory assistance.	0.147	0.038	AT&T, Internal Document